

Amendment(s) to the Claims

The following listing of claims replaces all prior versions and listings of claims in the present application:

Claim 1 (currently amended): A method of improving adhesion between the surface of one or more thermoplastic polyolefin elements and a ~~coating material~~ paint coat subsequently applied thereto, said method comprising:

supplying an adhesion promoter;

creating a mixture of said adhesion promoter and de-ionized water;

providing an enclosure, said enclosure forming a protective environment for the application of said mixture;

regulating the atmosphere within said enclosure;

providing said mixture to an application device located within said enclosure said application device having at least one nozzle;

placing said one or more thermoplastic polyolefin elements within said enclosure;

applying said mixture to said one or more thermoplastic polyolefin elements via said at least one nozzle of said adhesion promoter application device, such that said mixture flows over said one or more thermoplastic polyolefin elements;
and

regulating at least the angle and velocity at which said mixture contacts said one or more thermoplastic polyolefin elements; and

drying said one or more thermoplastic polyolefin elements after application of said mixture;

whereby a dried layer of said adhesion promoter is retained on the surface of said one or more thermoplastic polyolefin elements; and

~~wherein the presence of application of said mixture according to said method minimizes agitation of said mixture and thereby reduces or eliminates defects in said dried layer of adhesion promoter does not have a detrimental effect on the appearance of said subsequently applied coating material.~~

Claim 2 (canceled).

Claim 3 (original): The method of claim 1, wherein the average flow rate of said mixture through said at least one nozzle is between about 0.5-2.5 liters per minute.

Claim 4 (currently amended): The method of claim 2 1, wherein the distance between said at least one nozzle and the surface of said thermoplastic polyolefin elements is between about 0.25-14 inches.

Claim 5 (currently amended): The method of claim 2 1, wherein said adhesion promoter application device has between about 15-30 total nozzles.

Claim 6 (currently amended): The method of claim 2 1, wherein the diameter of said at least one nozzle is between approximately 0.25-0.5 inches.

Claim 7 (currently amended): The method of claim 2 1, wherein the opening diameter of said at least one nozzle is between approximately 0.5-1.0 millimeters.

Claim 8 (currently amended): The method of claim 2 1 wherein said at least one nozzle is oriented at an angle of between about 10-45 degrees relative to vertical.

Claim 9 (currently amended): The method of claim 8, wherein said orientation of said at least one nozzle is toward the direction of travel, ~~if~~ when said thermoplastic polyolefin elements travel through said application of said mixture.

Claim 10 (original): The method of claim 1, further comprising moving said thermoplastic polyolefin elements through the application of said mixture by said adhesion promoter application device.

Claim 11 (original): The method of claim 10, wherein the linear velocity of said thermoplastic polyolefin elements is between about 1-5 meters per minute.

Claim 12 (currently amended): The method of claim 10, wherein said thermoplastic polyolefin elements are oriented at an angle away from the direction of application of said mixture, ~~if~~ when said mixture is applied at an angle.

Claim 13 (currently amended): The method of claim 12, wherein said angle is between about 5-20 degrees.

Claim 14 (original): The method of claim 1, further comprising cleaning said thermoplastic polyolefin elements prior to said application of said mixture.

Claim 15 (original): The method of claim 14, further comprising rinsing said thermoplastic polyolefin elements with de-ionized water prior to application of said mixture.

Claim 16 (original): The method of claim 1, further comprising adjusting the temperature of said thermoplastic polyolefin elements to approximately the temperature of the portion of said enclosure that houses said adhesion promoter application device.

Claim 17 (original): The method of claim 16 wherein said temperature is between about 20-25°C.

Claim 18 (original): The method of claim 1, further comprising maintaining the relative humidity within said enclosure at between approximately 40-70%.

Claim 19 (original): The method of claim 1, wherein the amount of said adhesion promoter mixed with said water is regulated by a metering device.

Claim 20 (original): The method of claim 19 wherein a surface tension meter is adapted to analyze a wet sample of said mixture, said surface tension meter communicating with said metering device to provide regulation of the amount of said adhesion promoter added to said water based on said analysis

Claim 21 (original): The method of claim 1, further comprising providing a storage device for receiving an amount of said mixture.

Claim 22 (original): The method of claim 21, further comprising re-circulating said mixture within said storage device.

Claim 23 (original): The method of claim 22, further comprising filtering said mixture during said re-circulation.

Claim 24 (original): The method of claim 1, further comprising passing said mixture through a heat exchanger to regulate the temperature of said mixture prior to application by said adhesion promoter application device.

Claim 25 (original): The method of claim 24, wherein said means for supplying said mixture to said application device supplies said mixture from said heat exchanger to said adhesion promoter application device.

Claim 26 (original): The method of claim 25, wherein said means for supplying said mixture to said application device supplies said mixture from said heat exchanger to a gravity tank.

Claim 27 (original): The method of claim 26, wherein said gravity tank supplies said mixture to a supply header located within said enclosure.

Claim 28 (original): The method of claim 27, wherein said supply header has at least one nozzle extending therefrom and in communication with said mixture located therein, said supply header and said at least one nozzle forming at least a portion of said adhesion promoter application device.

Claim 29 (original): The method of claim 1, further comprising the use of at least a partial seal for sealing each end of said enclosure.

Claim 20 30 (currently amended): The method of claim 29, wherein said at least a partial seal is an air seal.

Claim 31 (original): The method of claim 30, wherein said air seal is provided by a fan.

Claim 32 (original): The method of claim 1, wherein said drying of said thermoplastic polyolefin elements occurs in an oven.

Claim 33 (original): The method of claim 32, wherein the temperature within said oven is between about 45-95°C.

Claim 34 (original): The method of claim 32, wherein the relative humidity within said oven is between about 5-25%.

Claim 35 (original): The method of claim 32, wherein said thermoplastic polyolefin elements enter a pre-oven prior to entering said oven.

Claim 36 (original): The method of claim 35, wherein the temperature within said pre-oven is between about 25-65°C.

Claim 37 (original): The method of claim 35, wherein the relative humidity within said pre-oven is between about 15-60%.

Claim 38 (currently amended): A method of improving adhesion between the surface of a thermoplastic polyolefin element and a subsequently applied ~~coating material~~ paint coat, said method comprising:

supplying a mixture of an adhesion promoter and de-ionized water;

providing an application enclosure, said enclosure forming a protective environment for the application of said mixture;

regulating the atmosphere within said application enclosure;

providing said mixture to a plurality of ~~spray~~ nozzles located within said application enclosure;

locating said thermoplastic polyolefin element within said application enclosure;

applying said mixture at a high flow rate to said thermoplastic polyolefin element via using said plurality of ~~spray~~ nozzles, such that said mixture flows over said thermoplastic polyolefin element;

regulating, during application of said mixture to said thermoplastic polyolefin element, one or more of a flow rate of said mixture, a discharge pattern of said plurality of ~~spray~~ nozzles, an angle of said plurality of said ~~spray~~ nozzles, a distance of said plurality of ~~spray~~ nozzles from said thermoplastic polyolefin element, and an orientation of said thermoplastic polyolefin element, in order to cover said thermoplastic polyolefin element with said mixture while minimizing the agitation thereof; and

drying said thermoplastic polyolefin element in a drying enclosure after application of said mixture;

whereby a dried layer of said adhesion promoter is retained on the surface of said thermoplastic polyolefin element; and

~~wherein, the presence of said dried layer of adhesion promoter does not have a detrimental effect on the appearance of said subsequently applied coating material~~ application of said mixture to said thermoplastic polyolefin element in such a manner minimizes or eliminates defects in said dried layer of adhesion promoter.

Claim 39 (currently amended): The method of claim 38, wherein the average flow rate of said mixture through said plurality of spray nozzles is between about 0.5-2.5 liters per minute.

Claim 40 (currently amended): The method of claim 38, wherein the distance between said plurality of spray nozzles and the surface of said thermoplastic polyolefin element is between about 0.25-14 inches.

Claim 41 (currently amended): The method of claim 38, wherein there are between about 15-30 total spray nozzles.

Claim 42 (currently amended): The method of claim 38, wherein the diameter of said plurality of spray nozzles is between approximately 0.25-0.5 inches.

Claim 43 (currently amended): The method of claim 38, wherein the opening diameter of said plurality of spray nozzles is between approximately 0.5-1.0 millimeters.

Claim 44 (currently amended): The method of claim 38, wherein at least some of said plurality of ~~spray~~ nozzles are oriented at an angle of between about 10-45 degrees relative to vertical.

Claim 45 (currently amended): The method of claim 44, further comprising moving said thermoplastic polyolefin element through said application of said mixture by said plurality of ~~spray~~ nozzles.

Claim 46 (currently amended): The method of claim 45, wherein said angle of said at least some of said plurality of ~~spray~~ nozzles is toward a direction of travel of said thermoplastic polyolefin element.

Claim 47 (original): The method of claim 45, wherein the linear velocity of said thermoplastic polyolefin element is between about 1-5 meters per minute.

Claim 48 (original): The method of claim 45, wherein said thermoplastic polyolefin element is angled toward a direction of travel of said thermoplastic polyolefin element.

Claim 49 (original): The method of claim 48, wherein said angle is between about 5-20 degrees.

Claim 50 (original): The method of claim 38, further comprising cleaning said thermoplastic polyolefin element prior to said application of said mixture.

Claim 51 (original): The method of claim 50, further comprising rinsing said thermoplastic polyolefin element with de-ionized water prior to application of said mixture.

Claim 52 (original): The method of claim 38, further comprising adjusting the temperature of said thermoplastic polyolefin element to approximately the temperature within said application enclosure.

Claim 53 (original): The method of claim 52, wherein said temperature is between about 20-25°C.

Claim 54 (original): The method of claim 38, wherein said atmosphere within said application enclosure is maintained at between approximately 40-70% relative humidity.

Claim 55 (original): The method of claim 38, wherein the amount of adhesion promoter mixed with water is regulated by a metering device.

Claim 56 (original): The method of claim 55, wherein a surface tension meter is adapted to analyze a wet sample of said mixture, said surface tension meter communicating with said metering device to provide regulation of the amount of said adhesion promoter added to said water based on said analysis.

Claim 57 (original): The method of claim 55, wherein said water is de-ionized water.

Claim 58 (original): The method of claim 38, further comprising providing a storage device for receiving and storing an amount of said mixture.

Claim 59 (original): The method of claim 58, further comprising re-circulating said mixture within said storage device.

Claim 60 (original): The method of claim 59, further comprising filtering said mixture during re-circulation.

Claim 61 (original): The method of claim 38, further comprising passing said mixture through a heat exchanger to regulate the temperature of said mixture prior to application by said plurality of spray nozzles.

Claim 62 (currently amended): The method of claim 61, wherein a pump supplies said mixture from said heat exchanger to said plurality of spray nozzles.

Claim 63 (original): The method of claim 61, wherein a pump supplies said mixture from said heat exchanger to a gravity tank.

Claim 64 (currently amended): The method of claim ~~53~~ 63, wherein said gravity tank supplies said mixture to a supply header located within said enclosure.

Claim 65 (currently amended): The method of claim ~~65~~ 64, wherein said plurality of ~~spray~~ nozzles are in communication with said mixture located in said supply header.

Claim 66 (original): The method of claim 38, further comprising the use of at least a partial seal for sealing each end of said enclosure.

Claim 67 (original): The method of claim 68, wherein said seal is an air seal.

Claim 68 (original): The method of claim 67, wherein said air seal is provided by a fan.

Claim 69 (currently amended): The method of claim 38, wherein the temperature within said ~~separate~~ drying enclosure is between about 45-95°C.

Claim 70 (original): The method of claim 38, wherein the relative humidity within said separate drying enclosure is between about 5-25%.

Claim 71 (original): The method of claim 38, wherein said thermoplastic polyolefin element enters a pre-oven prior to entering said drying enclosure.

Claim 72 (original): The method of claim 71, wherein the temperature within said pre-oven is between about 25-65°C.

Claim ~~74~~ 73 (currently amended): The method of claim 71, wherein the relative humidity within said pre-oven is between about 15-60%.

Claim 74 (currently amended): A method of improving adhesion between a thermoplastic polyolefin element and a subsequently applied ~~coating material~~ paint coat by depositing a layer of an adhesion promoter on the surface of said element, said method comprising:

supplying an adhesion promoter;

forming an adhesion promoter mixture from said adhesion promoter and de-ionized water;

providing a mixture storage tank for receiving and storing a supply of said mixture;

transferring at least a portion of said mixture to said mixture storage tank;

providing a mixture application enclosure, said mixture application enclosure having a regulated atmosphere and forming a protective environment around said thermoplastic polyolefin element during application of said mixture thereto;

providing a gravity tank for receiving a supply of said mixture from said mixture storage tank;

providing at least one supply header for receiving, via gravity from said gravity tank, an amount of said mixture;

providing a plurality of spray nozzles in communication with said at least one supply header, said plurality of spray nozzles adapted to be adjustable in location and direction, and to distribute said mixture received from said gravity tank over the surface of said thermoplastic polyolefin element;

locating said thermoplastic polyolefin element on a carrier;

cooling said thermoplastic polyolefin element to approximately the temperature within said mixture application enclosure;

angling at least some of said plurality of spray nozzles in a direction of travel of said conveyor;

running said thermoplastic polyolefin element through said mixture application enclosure on said conveyor while said mixture is emitted by said plurality of spray nozzles at a high flow rate, thereby applying causing said mixture to flow over said thermoplastic polyolefin element;

regulating, during application of said mixture to said thermoplastic polyolefin element, one or more of a flow rate of said mixture, a discharge pattern of said plurality of spray nozzles, a distance of said plurality of spray nozzles from said thermoplastic polyolefin element, the orientation of said thermoplastic polyolefin element on said conveyor, and the speed of said conveyor; and

passing said thermoplastic polyolefin element through a drying enclosure after application of said mixture;

whereby a dried layer of said adhesion promoter is thereafter retained on the surface of said thermoplastic polyolefin element; and

wherein, ~~due to the application of a substantially complete coating of said thermoplastic polyolefin element with~~ of said mixture and to said thermoplastic polyolefin element in such a manner, results in a reduction in the amount of foaming and splashing of said mixture that occurs during said application, the presence of, thereby reducing or eliminating defects in said dried layer of adhesion promoter does not have a detrimental effect on the appearance of said subsequently applied coating material, which defects would otherwise be inherently visible in said paint coat.

Claim 75 (currently amended): The method of claim 74, wherein the average flow rate of said mixture through said plurality of spray nozzles is between about 0.5-2.5 liters per minute.

Claim 76 (currently amended): The method of claim 74, wherein the distance between said plurality of spray nozzles and the surface of said thermoplastic polyolefin element is between about 0.25-14 inches.

Claim 77 (currently amended): The method of claim 74, wherein there are between about 15-30 total spray nozzles.

Claim 78 (currently amended): The method of claim 74, wherein the diameter of said plurality of spray nozzles is between approximately 0.25-0.5 inches.

Claim 79 (currently amended): The method of claim 74, wherein the opening diameter of said plurality of spray nozzles is between approximately 0.5-1.0 millimeters.

Claim 80 (currently amended): The method of claim 74, wherein said at least some of said plurality of spray nozzles are oriented at an angle of between about 10-45 degrees relative to vertical.

Claim 81 (original): The method of claim 74, wherein the linear velocity of said thermoplastic polyolefin element on said conveyor is between about 1-5 meters per minute.

Claim 82 (original): The method of claim 74, wherein said thermoplastic polyolefin element is angled toward a direction of travel of said conveyor.

Claim 83 (original): The method of claim 82, wherein said angle is between about 5-20 degrees.

Claim 84 (original): The method of claim 74, further comprising cleaning said thermoplastic polyolefin element prior to said application of said mixture.

Claim 85 (original): The method of claim 84, further comprising rinsing said thermoplastic polyolefin element with de-ionized water prior to application of said mixture.

Claim 86 (original): The method of claim 74, wherein said thermoplastic polyolefin element is cooled to a temperature of between about 20-25°C.

Claim 87 (original): The method of claim 74, wherein said atmosphere within said mixture application enclosure is maintained at between approximately 40-70% relative humidity.

Claim 88 (original): The method of claim 74, wherein the amount of adhesion promoter mixed with water is regulated by a metering device.

Claim 89 (original): The method of claim 88, wherein a surface tension meter is adapted to analyze a wet sample of said mixture, said surface tension meter communicating with said metering device to provide regulation of the amount of said adhesion promoter added to said water based on said analysis.

Claim 90 (original): The method of claim 74, wherein said water is de-ionized water.

Claim 91 (original): The method of claim 74, further comprising re-circulating said mixture within said mixture storage tank.

Claim 92 (original): The method of claim 91, further comprising filtering said mixture during re-circulation.

Claim 93 (currently amended): The method of claim 74, further comprising passing said mixture through a heat exchanger to regulate the temperature of said mixture prior to application by said plurality of spray nozzles.

Claim 94 (original): The method of claim 93, wherein a pump supplies said mixture from said heat exchanger to said gravity tank.

Claim 95 (original): The method of claim 74, further comprising the use of an air seal for sealing each end of said mixture application enclosure.

Claim 96 (original): The method of claim 95, wherein said air seal is provided by a fan.

Claim 97 (original): The method of claim 74, wherein the temperature within said drying enclosure is between about 45-95°C.

Claim 98 (original): The method of claim 74, wherein the relative humidity within said drying enclosure is between about 5-25%.

Claim 99 (original): The method of claim 74, further comprising passing said thermoplastic polyolefin element through a pre-oven prior to its introduction to said drying enclosure.

Claim 100 (original): The method of claim 99, wherein the temperature within said pre-oven is between about 25-65°C.

Claim 101 (original): The method of claim 99, wherein the relative humidity within said pre-oven is between about 15-60%.